

CLAIMS

SECTION 4.1

5 1. Cardiac prosthesis assembly comprising on the one hand a valve or ring prosthesis
and on the other hand a fixing device (10, 20, 30, 40, 50, 70, 90, 100, 120, 130, 140, 150,
160, 170, 180, 200) having a tubular element (11, 21, 31, 41, 51, 71, 97, 101, 111, 121,
131, 141, 151, 161, 171, 181, 207) adapted to accommodate said prosthesis, in which the
tubular element can be accommodated within a valve annulus (18, 80) of a heart and is
10 provided with a bottom flange (12, 22, 42, 52, 72, 92, 94, 96, 102, 112, 124, 134, 144, 154,
164, 172, 182, 205) and a top flange (13, 23, 33, 43, 53, 73, 91, 93, 95, 103, 113, 123, 133,
143, 153, 163, 173, 201), the bottom and top flanges extending in the peripheral direction
of the tubular element, and the bottom and top flanges having a first position in which they
extend outwards from the tubular element in order to be able to accommodate the valve
15 annulus between them for fixing the fixing device, characterised

in that the bottom flange is bent, or can be bent, reversibly, against a resilient force,
from the first position into a second position in which the projection of the bottom flange
on a radial transverse surface of the tubular element is located essentially on and/or within
the periphery of the tubular element;

20 and in that the bottom flange is fixed respectively can be fixed in said second
position in such a way that the fixing can be released in order to bend back the bottom
flange towards the first position under the influence of said resilient force.

25 2. Assembly according to Claim 1, characterised in that the top flange (23, 43, 53, 73,
91, 93, 95, 103, 113, 123, 133, 143, 153, 163, 173, 201) is bent, or can be bent, reversibly
from the first position, against a resilient force, into a second position in which the
projection of the top flange on a radial transverse surface of the tubular element (21, 41, 51,
71, 97, 101, 111, 121, 131, 141, 151, 161, 171, 181, 207) is located essentially on and/or
within the periphery of the tubular element;

30 and in that the top flange is fixed, respectively can be fixed, in said second position
in a manner such that the fixing can be released in order to cause the top flange to bend
back in the direction of the first position under the influence of said resilient force.

3. Assembly according to one of the preceding claims, characterised in that in the
first position the axial spacing between the bottom (12, 22, 42, 52, 72, 92, 94, 96, 102, 112,

124, 134, 144, 154, 164, 172, 182, 205) and the top flange (13, 23, 33, 43, 53, 73, 91, 93, 95, 103, 113, 123, 133, 143, 153, 163, 173, 201), in particular the outside edges thereof, is less than the thickness of the valve annulus (18, 80) to be accommodated between them in order to be able to clamp the valve annulus between the bottom and top flanges in the assembled position.

4. Assembly according to one of the preceding claims, characterised in that the bottom (12, 22, 42, 52, 72, 92, 94, 96, 102, 112, 124, 134, 144, 154, 164, 172, 182, 205) and the top flange (13, 23, 33, 43, 53, 73, 91, 93, 95, 103, 113, 123, 133, 143, 153, 163, 173, 201) in the first position are in a position in which they are pretensioned facing towards one another.

5. Assembly according to one of the preceding claims, characterised in that the bottom (12, 22, 42, 52, 72, 92, 94, 96, 112, 124, 134, 144, 154, 164, 172, 182, 205) and/or top flange (13, 23, 33, 43, 53, 73, 91, 93, 95, 113, 123, 133, 143, 153, 163, 173, 201) comprises a number of fingers arranged distributed around the periphery of the tubular element (11, 21, 31, 41, 51, 71, 97, 111, 121, 131, 141, 151, 161, 171, 181, 207) and separated from one another by incisions, cut-outs or folds (15, 25, 27, 35).

6. Assembly according to one of the preceding claims, characterised in that the tubular element (31, 71) is integrated with the valve (39) or ring (70) prosthesis or with a, preferably round or cylindrical, housing thereof.

7. Assembly according to one of the preceding Claims 1 - 5, characterised in that the tubular element (41), is provided with a lower limit (47, 49) in order to prevent the valve prosthesis (44) positioned in the tubular element (41) after implantation of the cardiac prosthesis fixing device (40) from becoming detached in the downward direction from the tubular element (41) and/or with a top closure (47, 49) in order to prevent the valve prosthesis (44) fitted in the tubular element (41) after implantation of the cardiac prosthesis fixing device (40) from becoming detached in the upward direction from the tubular element (41).

8. Assembly according to Claim 7, characterised in that the lower limit can comprise a stop, such as an inward-pointing rib extending in the peripheral direction, arranged inside the tubular element at the bottom thereof.

9. Assembly according to Claim 7 or Claim 8, characterised in that the top closure comprises a screw ring or snap-fit ring and/or resilient lips.

10. Assembly according to one of Claims 7 - 9, characterised in that the valve

prosthesis (44) can be accommodated in the tubular element (41) such that it is rotatable about its longitudinal axis, for example by means of a screw thread connection, a bayonet fitting or an interacting system of a peripheral recess (49) in the one part and one or more ribs (47) on the other part, the assembly (40) furthermore preferably being provided with a twist lock in order to be able to fix the tubular element (41) and the valve prosthesis (44) in a desired position with respect to one another.

11. Assembly according to one of the preceding claims, characterised in that the bottom (92, 94, 96, 102) and top (91, 93, 95, 103) flanges are at least partially arranged in accordance with a sinusoidal pattern (80, 81) in the peripheral direction of the tubular element (97, 101).

12. Assembly according to Claim 11, characterised in that the sinusoidal path (80, 81) will have a length of three sine periods together spanning the circumference of the tubular element (97, 101).

13. Assembly according to one of the preceding claims, characterised in that the tubular element is a sinusoidally wave-shaped ring or sinusoidally wave-shaped cylindrical element with three sine periods.

14. Assembly according to one of the preceding claims, wherein the valve annulus (80) to be accommodated between the bottom (92, 94, 96) and top (91, 93, 95) flanges has a sine-wave shape (80) three periods long, characterised in that the top (91, 93, 95) and bottom (92, 94, 96) flanges comprise flange segments (95, 96) for clamping the sine wave troughs of the valve annulus (80), which flange segments (95, 96) are preferably positioned approximately 120° apart.

15. Assembly according to one of the preceding claims, wherein the valve annulus (80) to be accommodated between the bottom (92, 94, 96) and top (91, 93, 95) flanges has a sine-wave shape three periods long, characterised in that the top (91, 93, 95) and bottom (92, 94, 96) flanges comprise flange segments (91, 92) for clamping the sine wave peaks of the valve annulus (80), which flange segments (91, 92) are preferably positioned approximately 120° apart.

16. Assembly according to one of the preceding claims, wherein the valve annulus (80) to be accommodated between the bottom (92, 94, 96) and top (91, 93, 95) flanges has a sine-wave shape (80) three periods long, characterised in that the top (91, 93, 95) and bottom (92, 94, 96) flanges comprise flange segments (93, 94) for clamping the sine wave origins of the valve annulus (80), which flange segments (93, 94) are preferably positioned

approximately 60° apart.

17. Assembly according to one of the preceding claims, characterised in that the outer surface of the tubular element (11, 21, 31, 41, 51, 71, 111, 171) is concave.

18. Assembly according to one of the preceding claims, characterised in that the
5 bottom (12, 112, 124, 134, 144, 154, 162) and/or top (13, 113, 123, 133, 143, 153, 163) flange or fingers of the bottom and/or top flanges is/are provided with anchoring means, such as barbs, points or roughenings, for anchoring in the valve annulus (18, 80).

19. Assembly according to one of the preceding claims, characterised in that said
10 device (170, 180) further comprises fixing means (175, 184) for releasably fixing the bottom (172, 183) and/or top (173) flange in the second position.

20. Assembly according to Claim 19, characterised in that the fixing means (175, 184) comprise at least one annular element, such as a sleeve (175), ring or suture (184), which, when in the second position, are placed or can be placed around the bottom (172) and/or top (173) flange.

15 21. Assembly according to Claim 19, characterised in that the fixing means comprise a sleeve (175) in which the tubular element (171) with the bottom flange (172) in the second position and optionally the top flange (173) in the second position can be accommodated or have been accommodated in such a way that the tubular element (171), the bottom flange (172) and the optional top flange (173) can be pushed out of the sleeve
20 (175) by retracting the sleeve from the tubular element (171) in the longitudinal direction facing away from the bottom flange (172).

22. Assembly according to Claim 19 or 20, characterised in that the valve prosthesis is fitted in the tubular element (181) and in that the fixing means comprise a suture (184) which is stretched taut around the bottom flange (182) in the second position and the two
25 ends of the suture (184) run over the outside of the tubular element (181) or through the wall of the tubular element to that side of the tubular element which faces away from the bottom flange in order to be fixed in place at that side or beyond that end, it being possible to remove the suture after detaching the one end of the suture by pulling on the other end of the suture and those parts of the suture running over the tubular element preferably being
30 guided in guide means, such as small tubes or conduits.

SECTION 4.2

23. Prosthesis fixing device (410, 420, 430, 440, 450, 460, 470, 480, 490, 500) comprising a tubular element (416, 451, 474, 481) intended to lie, when the prosthesis fixing device is in the fitted position, with the outside in contact with the peripheral wall (445, 467) part of the circulatory system and to accommodate a prosthesis (417, 418, 419; 485; 510, 517, 518), such as a valve prosthesis, inside it, the tubular element having pins (412; 422, 426; 432; 442, 444; 453; 463; 473; 483; 492, 496; 502, 506) arranged distributed around the periphery, which pins have pointed ends for penetrating the peripheral wall when the prosthesis fixing device is in the fitted position, characterised in that the pointed ends face in radially outward direction of the tubular element, in that each pin is arranged on an arm (411, 421, 431, 441, 443, 452, 462, 472, 482, 491, 494, 501, 504) which, via a fold line or bending line, is attached by one end to the tubular element in a manner which permits swinging around said fold line or bending line, and in that the arms and pins are movable, by swinging about the fold line respectively bending line, from an insertion position, in which they are essentially located inside the tubular element, into a fixing position in which at least the pins, viewed in the radial direction, project outside the tubular element.

24. Prosthesis fixing device (410, 420, 430, 440, 450, 460, 470, 480, 490, 500) according to Claim 23, characterised in that the arms (411, 421, 431, 441, 443, 452, 462, 472, 482, 491, 494, 501, 504) and pins (412; 422, 426; 432; 442, 444; 453; 463; 473; 483; 492, 496; 502, 506) are located within the longitudinal boundaries of the tubular element (416, 451, 474, 481) in the insertion position and in that the tubular element is provided with radial passages (413, 423, 433, 448, 454, 461, 473, 484, 493, 497, 503) located alongside the pins in the radial direction, in particular slit-shaped passages extending in the longitudinal direction of the arms, such that the pins are able to emerge through these passages on swinging from the insertion position into the fixing position.

25. Prosthesis fixing device (410, 420, 430, 440, 450, 460, 470, 480, 490, 500) according to Claim 23 or 24, characterised in that the arms (411, 421, 431, 441, 443, 452, 462, 472, 482, 491, 494, 501, 504), viewed in the longitudinal direction of the tubular element (416, 451, 474, 481), extend essentially in said longitudinal direction.

26. Prosthesis fixing device according (420) to one of Claims 23 - 25, characterised in that each arm (421) has at least two pins.(422, 426).

27. Prosthesis fixing device (410, 420, 430, 440, 450, 460, 470, 480, 490, 500) according to one of Claims 23 - 26, characterised in that the arms (411, 421, 431, 441, 443, 452, 462, 472, 482, 491, 494, 501, 504), viewed from the fold line respectively bending line point away from the heart in the insertion position.

5 28. Prosthesis fixing device (440, 460) according to one of Claims 23 - 27, characterised in that the tubular element has a bottom (447, 464) and/or top (446, 465) flange extending in the circumferential direction of the tubular element, which flange (446, 447) , at least in the fitted position, projects outwards with respect to the tubular element in order to come into contact with, or at least to overlap, the bottom or, respectively, the top
10 of surrounding vascular wall tissue (445, 467), such as the valve annulus.

29. Prosthesis fixing device (460) according to Claim 28, characterised in that the bottom (464) or, respectively, top (465) flange has a number of flange fingers separated from one another by incisions, cut-outs or folds and arranged distributed around the periphery of the tubular element.

15 30. Prosthesis fixing device (410, 420, 430, 480, 490, 500), according to one of Claims 23 - 29, characterised in that the tubular element (416) is provided with a lower limit (415, 418; 425; 435; 488; 495; 505, 518) in order to prevent a prosthesis (417, 418, 419; 485; 510, 518, 517), such as a valve prosthesis, placed in the tubular element after implantation of the prosthesis fixing device (410, 420, 430, 480, 490, 500) from detaching
20 from the tubular element in the downward direction and/or with a top closure (415, 418; ; 425; 435; 482, 483; 495; 505, 518) in order to prevent a prosthesis (417, 418, 419), such as a valve prosthesis, placed in the tubular element after implantation of the prosthesis fixing device (410, 420, 430, 480, 490, 500) from detaching from the tubular element in the upward direction.

25 31. Prosthesis fixing device (480) according to Claim 30, characterised in that the lower limit (488) comprises a stop arranged inside the tubular element at the bottom thereof, such as an inward-pointing rib extending in the circumferential direction.

32. Prosthesis fixing device (480) according to Claim 30 or 31, characterised in that the top closure comprises a screw ring or a snap-fit ring and/or resilient snap-fit lips (482,
30 483).

33. Prosthesis fixing device (410, 420, 430, 480, 490, 500) according to one of Claims 30 - 32, characterised in that the prosthesis (417, 418, 419; 485; 510, 518, 517) can be accommodated in the tubular element such that it can be turned about its longitudinal

axis, for example by means of a screw thread connection, a bayonet connection or a combination of peripheral recesses (415, 425; 435; 495; 505) in the one part and one or more ribs (418; 518) on the other part interacting therewith, the prosthesis fixing device preferably also being provided with a twist lock in order to be able to fix the tubular body and the valve prosthesis in a desired position with respect to one another.

34. Prosthesis fixing device (470) according to one of Claims 23 - 33, characterised in that the arms (472) and pins are arranged at least partially in accordance with a sine wave-like pattern (475) in the peripheral direction of the tubular element (474).

35. Prosthesis fixing device according to Claim 34, characterised in that the sine wave path (475) has a length of three sine periods together spanning the periphery of the tubular element (474).

36. Prosthesis fixing device according to one of Claims 23 - 35, characterised in that the tubular element is a sine-wave-shaped ring or sine-wave-shaped cylindrical element with three sine wave periods.

37. Prosthesis fixing device according to one of Claims 23 - 36, characterised in that the arms provided with pins have been bent, or can be bent, against a resilient force from an initial position, corresponding to essentially the fitted position, into the insertion position and are fixed or can be fixed in said insertion position in such a way that the fixing can be released in order to cause the arms provided with pins to bend back to, or at least in the direction of, the fitted position under the influence of the resilient force.

38. Prosthesis fixing device (440, 460) according to one of Claims 23 - 37, characterised in that at least part of the external surface of the tubular element is concave.

39. Prosthesis fixing device (440, 490, 500) according to one of Claims 23 - 38, characterised in that the tubular element is provided with two or more rows of arms (441, 443; 491, 494; 501, 504), provided with pins (442, 444; 492, 496; 502, 506), running in the peripheral direction.

40. Assembly comprising a valve prosthesis and a prosthesis fixing device according to one of claims 23-39, the valve prosthesis preferably comprising a cylindrical outer body (417) fitting in the tubular element.

SECTION 4.3

41. Fixing device (600, 620, 640, 650, 670, 680, 690, 710) for fixing to vascular wall

tissue (601, 621, 641, 642, 696), comprising a tubular element (610, 630, 643, 651, 711) which can be accommodated within a passage (612, 647, 718) surrounded by the vascular wall tissue and is provided with bottom fingers (609, 629, 644, 654, 671, 681, 692, 716) arranged distributed in the peripheral direction of the tubular element and with top fingers
 5 (608, 628, 645, 652, 672, 682, 691, 715) arranged distributed in the peripheral direction of the tubular element, the bottom and top fingers having a first position in which they project outwards from the tubular element with respect to the axial direction of the tubular element in order to be able to accommodate between them the vascular wall tissue surrounding the passage,

10 wherein both the bottom and the top fingers have been bent aside, or can be bent aside, reversibly, against a resilient force, from the first position into a second position in which the projection of the bottom and top fingers on a radial transverse surface of the tubular element is located essentially on and/or within the periphery of the tubular element;

and wherein the bottom and top fingers are fixed respectively can be fixed in said
 15 second position by a sleeve (603, 623, 693, 700, 717) in which the tubular element and the bottom and top fingers which are in the second position have been accommodated respectively can be accommodated such that the tubular element, the bottom fingers and the top fingers can be slid out of the sleeve by sliding the sleeve in the longitudinal direction of the tubular element, in order to allow the bottom and top fingers to return to
 20 the first position,

characterised in that the sleeve (700) has a pointed end edge (702), such as an end sloping, tapered or curved with respect to the axial direction of the sleeve, and in that the end edge (702) is sharpened to form a cutting edge.

42. Fixing device (600) according to Claim 41, characterised in that, when the fingers
 25 are in the second position, the ends of the bottom fingers span, with their ends, a surface following the same course as the surface spanned by the pointed end of the sleeve.

43. Fixing device (600, 620, 640, 650, 670, 680, 690, 710) according to Claim 41 or 42, characterised in that the bottom (609, 629, 644, 654, 671, 681, 692, 716) and top (608, 628, 645, 652, 672, 682, 691, 715) fingers extend essentially axially in opposing directions
 30 in the second position.

44. Fixing device (600, 620, 640, 650, 670, 680, 710) according to one of Claims 41-43, characterised in that the bottom (609, 629, 644, 654, 671, 681, 716) and top (608, 628, 645, 652, 672, 682, 715) fingers, in the first position, extend in the radial direction with

respect to the tubular element (610, 630, 643, 651, 711).

45. Fixing device (620, 690), according to one of Claims 41 - 43 characterised in that the bottom (629, 692) and/or the top (628) fingers have pointed ends.

5 46. Fixing device (600, 640, 650, 670, 680, 710) according to one of Claims 41 - 45, characterised in that the bottom (609, 644, 654, 671, 681, 716) and/or top (608, 645, 652, 672, 682, 715) fingers, in their first position, define a flange surface extending uninterrupted or with interruptions around the tubular element (610, 643, 651, 673, 683, 711).

10 47. Fixing device (600, 640, 650, 670, 680, 690, 710) according to one of Claims 41 - 46, characterised in that in the first position the axial spacing between the top (608, 645, 652, 672, 682, 691, 715) and bottom (609, 644, 654, 671, 681, 692, 716) fingers, in particular the ends thereof, is less than the thickness of the vascular wall tissue (601, 641, 642, 696) to be accommodated between them in order to be able to clamp the vascular wall tissue between the bottom and top fingers in the fitted position.

15 48. Fixing device (600, 640, 650, 670, 680, 690, 710) according to one of Claims 41 - 47, characterised in that in the first position the bottom (609, 644, 654, 671, 681, 692, 716) and top (608, 645, 652, 672, 682, 691, 715) fingers are pretensioned and face towards one another.

20 49. Fixing device (600, 650, 670, 680, 690, 710) according to one of Claims 41 - 48, characterised in that the tubular element (610, 651, 673, 683, 711) is provided with a lower limit (607, 655, 674, 684) in order to prevent a prosthesis, such as an obturator cap or valve or vascular prosthesis or cannula or working conduit, placed in the tubular element after implantation of the fixing device from detaching from the tubular element in the downward direction and/or with a top closure (607, 655, 674, 684) in order to prevent a prosthesis, 25 such as an obturator cap or valve or vascular prosthesis or cannula or working conduit, placed in the tubular element after implantation of the fixing device from detaching from the tubular element in the upward direction.

50. Fixing device (600, 650, 670, 680, 690, 710) according to Claim 49 in combination with the characterising part of Claim 8 or 9.

30 51. Fixing device (600, 650, 670, 680, 690, 710) according to Claim 49 or 50, characterised in that the prosthesis, such as an obturator cap or vascular prosthesis or cannula or working conduit, can be accommodated in the tubular element (610, 651, 673, 683, 711) such that it can be turned about its longitudinal axis, for example by means (607,

655, 674, 684) of a screw thread connection, a bayonet connection or a combination of a peripheral recess in the one part and one or more ribs on the other part interacting therewith, the fixing device preferably also being provided with a twist lock in order to be able to fix the tubular element and the prosthesis, such as an obturator cap or vascular prosthesis or cannula or working conduit, in a desired position with respect to one another.

52. Fixing device (600, 620, 640, 650, 670, 680, 690, 710) according to one of Claims 41 - 51 in combination with the characterising part of one or more of Claims 17 - 22.

53. Assembly of a fixing device (600, 620, 640, 650, 670, 680, 690, 710) according to one of the preceding claims and an obturator cap (660), which can be accommodated therein, for occluding the passage surrounded by the tubular or tube-like element, wherein the obturator cap is preferably covered on one or both sides with vascular wall tissue, pericardium, vascular prosthesis or anti-clotting material.

54. Fixing device (600, 620, 640, 650, 670, 680, 690, 710) according to one of Claims 41 - 53, wherein the outer flange fingers, and/or the inner flange fingers, are made from a superelastic metal alloy or an alloy with a shape memory which has been activated/can be activated by heat, such as a nickel-titanium alloy, for example nitinol.

SECTION 4.4

55. Fixing device (740, 750, 760, 770, 780) for fixing to the end of a vessel (745, 746), comprising:

- a tubular body (747, 753, 747) having a tubular inner flange (716, 741, 751, 752) formed thereon for accommodating in the interior of the end of the vessel (746);

- an outer flange (715, 743, 754, 755, 782) to be located, in a fixing position, around the end of the vessel (745, 746), around and in contact with the outside of the vascular wall tissue, which outer flange (715, 743, 754, 755, 782), in said fixing position, is tubular, runs around the inner flange (716, 741, 751, 752) and overlaps the latter, the outer flange (715, 743, 754, 755, 782) being bendable or bent from the fixing position, against a resilient force, into a pretensioned fitting position located further away from the inner flange (716, 741, 751, 752), and the outer flange (715, 743, 754, 755, 782), in said pretensioned fitting position, being fixable respectively fixed in such a way that said fixing can be released in order to cause the outer flange to bend back in the direction of the fixing position under the

influence of the pretension.

56. Fixing device (740, 750, 760, 770, 780) according to Claim 25, wherein the inner flange (716, 741, 751, 752) is bendable or has been bent from the fixing position, against a resilient force, into a pretensioned fitting position located a greater distance away from the outer flange (715, 743, 754, 755, 782), and the inner flange (716, 741, 751, 752) is fixable respectively has been fixed in said pretensioned fitting position in such a way that said fixing can be released in order to cause the inner flange (716, 741, 751, 752) to bend back in the direction of the fixing position under the influence of the pretension.

57. Fixing device (740, 750, 760, 770, 780) according to Claim 55 or 56, wherein the outer flange (715, 743, 754, 755, 782), and/or the inner flange (716, 741, 751, 752), are/is made from a superelastic metal alloy or an alloy with a shape memory which has been activated/can be activated by heat, such as a nickel-titanium alloy, for example nitinol.

58. Fixing device (740, 760) according to one of Claim 55 - 57, wherein, in the fitting position, the outer flange (715, 743) extends in a direction essentially opposed to that of the inner flange (716, 741) and wherein the outer flange (715, 743) is fixed respectively is fixable in the fitting position by means of a sleeve (717, 744) in which the outer flange (715, 743) is accommodated.

59. Fixing device (750) according to one of Claims 55 - 58, comprising two of said inner flanges (751, 752) which extend essentially in the extension of one another and comprising two of said outer flanges (754, 755) which in the fitting position are essentially transverse to the inner flanges (751, 752), with the outsides facing one another.

60. Fixing device (750) according to Claim 59, comprising a U-shaped annular element (757) opening towards the middle, in which the ends of the outer flanges (754, 755) can be accommodated respectively are accommodated in the fitting position.

61. Fixing device (740, 770) according to one of Claims 40 - 58, wherein the tubular element (747) is provided all round with suture passages (742).

62. Fixing device (800, 820, 821) for fixing in a passage (814) surrounded by vascular wall tissue (806, 807), comprising:

- a tubular element (801, 825) that delimits a passage,
- an outer flange (802, 826) on the tubular element (801, 825) to come into contact, at the access side of the passage, with the vascular wall tissue (806, 807) surrounding the passage,
- an inner flange (803, 827, 828) made up of inner flange segments,

wherein each inner flange segment is arranged on an arm (804), one end of which is, via a fold line or beding line, attached to the tubular element (801, 825) in a manner which allows swinging about said fold line respectively bending line, the inner flange segments extending in a radially outward direction from said arms, and

5 wherein the arms (804) and inner flange segments (803, 827, 828) are movable, by swinging about the fold line respectively bending line, from an insertion position, located essentially within the outline of the passage, into a fixing position in which the inner flange segments, overlapping the outer flange (802, 826), can come into contact, on that side of the passage which faces away from the access side, with the vascular wall tissue
10 surrounding the passage.

63. Fixing device according to Claim 62, characterised in that the inner flange segments and/or arms are located within the longitudinal boundaries of the tubular element in the insertion position and in that the tubular element and/or outer flange is provided with radial passages located alongside the inner flange segments and/or arms in the radial
15 direction, in particular slit-shaped passages extending in the longitudinal direction of the arms, such that the inner flange segments and/or arms emerge through these passages on swinging from the insertion position into the fixing position.

64. Fixing device according to one or more of Claims 62-63, characterised in that the inner flange segments and/or arms have been bent, or can be bent, against a resilient force
20 from an initial position corresponding to essentially the fitted position into the insertion position and are fixed respectively can be fixed in said insertion position in such a way that the fixing can be released in order to cause the inner flange segments and/or arms to bend back to, or at least in the direction of, the fitted position under the influence of the resilient force.

25 65. Fixing device according to one or more of Claims 62 - 64, characterised in that the inner flange segments and/or arms can be fixed in an insertion position by means of a sleeve and/or an assembly of securing pins, which can be located on the outside, in the wall or on the inside of the tubular element, optionally making use of one or more passages through the inner flange segments and/or arms, such that by sliding the sleeve and/or
30 securing pins in the longitudinal direction of the tubular element the inner flange segments and/or arms can be slid out of the sleeve and/or securing pins in order to allow the inner flange segments and/or arms to return to the initial position.

66. Fixing device according to one or more of Claims 62 - 65, wherein the inner

flange segments and/or arms are made from a superelastic metal alloy or an alloy with a shape memory which has been activated/can be activated by heat, such as a nickel-titanium alloy, for example nitinol.

5 67. Fixing device according to Claims 62 - 66, characterised in that the tubular element is provided with a lower limit in order to prevent a prosthesis, such as an obturator cap or vascular prosthesis or cannula or working conduit, placed in the tubular element after implantation of the fixing device from detaching from the tubular element in the downward direction, and/or with a top closure in order to prevent a prosthesis, such as an obturator cap or vascular prosthesis or cannula or working conduit, placed in the tubular
10 element after implantation of the fixing device from detaching from the tubular element in the upward direction.

68. Fixing device according to Claims 62 - 67 in combination with the characterising part of Claim 8 or 9.

15 69. Fixing device according to Claim 62 or 68, characterised in that the prosthesis, such as an obturator cap or vascular prosthesis or cannula or working conduit, can be accommodated in the tubular element such that it can be turned about its longitudinal axis, for example by means of a screw thread connection, a bayonet connection or a combination of a peripheral recess in the one part and one or more ribs on the other part interacting therewith, the fixing device preferably also being provided with a twist lock in order to be
20 able to fix the tubular element and the prosthesis in a desired position.

70. Fixing device according to one of Claims 62 - 69 in combination with the characterising part of one or more of Claims 17 - 22.

25 71. Assembly of a fixing device according to one of the preceding Claims 62 - 70 and an obturator cap, which can be accommodated therein, for occluding the passage surrounded by the tubular or tube-like element, wherein the obturator cap is preferably covered on one or both sides with vascular wall tissue, pericardium, vascular prosthesis or anti-clotting material.

72. A prosthesis fixing device comprising:

30 a tubular element intended to lie, when the prosthesis fixing device is in the fitted position, with the outside in contact with the peripheral wall part of the circulatory system and to accommodate a prosthesis, inside it, the tubular element having pins arranged distributed around the periphery, said pins having pointed ends for penetrating the peripheral wall when the prosthesis fixing device is in the fitted position,

wherein the pointed ends face in radially outward direction of the tubular element, and each pin is arranged on an arm which, via a fold line or bending line, is attached by one end to the tubular element in a manner which permits swinging around said fold line or bending line, and

5 wherein the arms and pins are movable, by swinging about the fold line respectively bending line, from an insertion position, in which they are essentially located inside the tubular element, into a fixing position in which at least the pins, viewed in the radial direction, project outside the tubular element.

73. The prosthesis fixing device according to Claim 72, characterised in that the arms
10 and pins are located within the longitudinal boundaries of the tubular element in the insertion position and in that the tubular element is provided with radial passages located alongside the pins in the radial direction, in particular slit-shaped passages extending in the longitudinal direction of the arms, such that the pins are able to emerge through these passages on swinging from the insertion position into the fixing position.

15 74. The prosthesis fixing device according to Claim 72, characterised in that the arms, viewed in the longitudinal direction of the tubular element, extend essentially in said longitudinal direction.

75. The prosthesis fixing device according to claim 73, characterised in that the arms extend in tangential direction of the tubular element.

20 76. The prosthesis fixing device according to Claim 72, characterised in that each arm has at least two pins.

77. The prosthesis fixing device according to Claim 72, characterised in that the arms viewed from the fold line respectively bending line point away from the surrounding vascular tissue.

25 78. The prosthesis fixing device according to Claim 72, characterised in that the tubular element has a bottom and/or top flange extending in the circumferential direction of the tubular element, which flange, at least in the fitted position, projects outwards with respect to the tubular element in order to come into contact with, or at least to overlap, the bottom or, respectively, the top of surrounding vascular wall tissue, such as the valve
30 annulus.

79. The prosthesis fixing device according to Claim 78, characterised in that the bottom or, respectively, top flange has a number of flange fingers separated from one another by incisions, cut-outs or folds and arranged distributed around the periphery of the

tubular element.

80. The prosthesis fixing device according to claim 79, characterised in that the ends of the flange fingers each carry a said pin, and in that said fingers form said arms.

5 81. The prosthesis fixing device according to Claim 72, characterised in that the tubular element is provided with a lower limit in order to prevent a prosthesis, such as a valve prosthesis, placed in the tubular element after implantation of the prosthesis fixing device from detaching from the tubular element in the downward direction and/or with a top closure in order to prevent a prosthesis, such as a valve prosthesis, placed in the tubular element after implantation of the prosthesis fixing device from detaching from the tubular
10 element in the upward direction.

82. The prosthesis fixing device according to Claim 81, characterised in that the lower limit comprises a stop arranged inside the tubular element at the bottom thereof, such as an inward-pointing rib extending in the circumferential direction.

15 83. The prosthesis fixing device according to Claim 81, characterised in that the top closure comprises a screw ring or a snap-fit ring and/or resilient snap-fit lips.

84. The prosthesis fixing device according to Claim 81, characterised in that the prosthesis can be accommodated in the tubular element such that it can be turned about its longitudinal axis, for example by means of a screw thread connection, a bayonet connection or a combination of peripheral recesses in the one part and one or more ribs on
20 the other part interacting therewith, the prosthesis fixing device also being provided with a twist lock in order to be able to fix the tubular and the valve prosthesis in a desired position with respect to one another.

25 85. The prosthesis fixing device according to Claim 72, characterised in that the arms and pins are arranged at least partially in accordance with a sine wave-like pattern in the peripheral direction of the tubular element.

86. The prosthesis fixing device according to Claim 85, characterised in that the sine wave path has a length of three sine periods together spanning the periphery of the tubular element.

30 87. The prosthesis fixing device according to Claim 72, characterised in that the tubular element is a sine-wave-shaped ring or sine-wave-shaped cylindrical element with three sine wave periods.

88. The prosthesis fixing device according to Claim 72, characterised in that the arms provided with pins have been bent, or can be bent, against a resilient force from an initial

position, corresponding to essentially the fitted position, into the insertion position and are fixed or can be fixed in said insertion position in such a way that the fixing can be released in order to cause the arms provided with pins to bend back to, or at least in the direction of, the fitted position under the influence of the resilient force.

5 89. The prosthesis fixing device according to Claim 72, characterised in that at least part of the external surface of the tubular element is concave.

90. The prosthesis fixing device according to Claim 72, characterised in that the tubular element is provided with two or more rows of arms, provided with pins, running in the peripheral direction.

10 91. An assembly comprising a valve prosthesis and a prosthesis fixing device according to Claim 72, the valve prosthesis comprising a cylindrical outer body fitting in the tubular element.

92. A fixing device for fixing in a passage surrounded by vascular wall tissue, comprising:

15 a tubular element that delimits a passage;

an outer flange on the tubular element to come into contact, at the access side of the passage, with the vascular wall tissue surrounding the passage; and

an inner flange made up of inner flange segments;

20 wherein each inner flange segment is arranged on an arm, one end of which is, via a fold line or bending line, attached to the tubular element in a manner which allows swinging about said fold line respectively bending line, the inner flange segments extending in a radially outward direction from said arms, and

25 wherein the arms and inner flange segments are movable, by swinging about the fold line respectively bending line, from an insertion position, located essentially within the outline of the passage, into a fixing position in which the inner flange segments, overlapping the outer flange, can come into contact, on that side of the passage which faces away from the access side, with the vascular wall tissue surrounding the passage.

30 93. The fixing device according to Claim 92, characterised in that the inner flange segments and/or arms are located within the longitudinal boundaries of the tubular element in the insertion position and in that the tubular element and/or outer flange is provided with radial passages located alongside the inner flange segments and/or arms in the radial direction, in particular slit-shaped passages extending in the longitudinal direction of the arms, such that the inner flange segments and/or arms emerge through these passages on

swinging from the insertion position into the fixing position.

94. The fixing device according to Claim 92, characterised in that the inner flange segments and/or arms have been bent, or can be bent, against a resilient force from an initial position corresponding to essentially the fitted position into the insertion position and are fixed respectively can be fixed in said insertion position in such a way that the fixing can be released in order to cause the inner flange segments and/or arms to bend back to, or at least in the direction of, the fitted position under the influence of the resilient force.

95. The fixing device according to Claim 92, characterised in that the inner flange segments and/or arms can be fixed in an insertion position by means of a sleeve and/or an assembly of securing pins, which can be located on the outside, in the wall or on the inside of the tubular element, optionally making use of one or more passages through the inner flange segments and/or arms, such that by sliding the sleeve and/or securing pins in the longitudinal direction of the tubular element the inner flange segments and/or arms can be slid out of the sleeve and/or securing pins in order to allow the inner flange segments and/or arms to return to the initial position.

96. The fixing device according to Claim 92, wherein the inner flange segments and/or arms are made from a superelastic metal alloy or an alloy with a shape memory which has been activated/can be activated by heat, such as a nickel-titanium alloy, for example nitinol.

97. The fixing device according to Claim 92, characterised in that the tubular element is provided with a lower limit in order to prevent a prosthesis, such as an obturator cap or vascular prosthesis or cannula or working conduit, placed in the tubular element after implantation of the fixing device from detaching from the tubular element in the downward direction, and/or with a top closure in order to prevent a prosthesis, such as an obturator cap or vascular prosthesis or cannula or working conduit, placed in the tubular element after implantation of the fixing device from detaching from the tubular element in the upward direction.

98. The fixing device according to Claim 97, characterised in that the lower limit comprise a stop arranged inside the tubular element at the bottom thereof.

99. The fixing device according to Claim 97, characterised in that the top closure comprises a screw ring or snap-fit ring and/or resilient lips.

100. The fixing device according to Claim 92, characterised in that the prosthesis can be accommodated in the tubular element such that it can be turned about its longitudinal

axis, for example by means of a screw thread connection, a bayonet connection or a combination of a peripheral recess in the one part and one or more ribs on the other part interacting therewith, the fixing device also being provided with a twist lock in order to be able to fix the tubular element and the prosthesis in a desired position.

5 101. The fixing device according to Claim 92, characterised in that the outer surface of the tubular element is concave.

102. The fixing device according to Claim 92, characterised in that the bottom and/or top flange or fingers of the bottom and/or top flanges is/are provided with anchoring means, such as barbs, points or roughenings, for anchoring in the valve annulus.

10 103. The fixing device according to Claim 92, characterised in that said device further comprises fixing means for releasably fixing the bottom and/or top flange in the second position.

104. The fixing device according to Claim 92, characterised in that the fixing means comprise at least one annular element, such as a sleeve, ring or suture, which, when in the
15 second position, are placed or can be placed around the bottom and/or top flange.

105. The fixing device according to Claim 92, characterised in that the fixing means comprise a sleeve in which the tubular element with the bottom flange in the second position and optionally the top flange in the second position can be accommodated or have been accommodated in such a way that the tubular element, the bottom flange and the
20 optional top flange can be pushed out of the sleeve by retracting the sleeve from the tubular element in the longitudinal direction facing away from the bottom flange.

106. The fixing device according to Claim 92, characterised in that the valve prosthesis is fitted in the tubular element and in that the fixing means comprise a suture which is stretched taut around the bottom flange in the second position and the two ends of
25 the suture run over the outside of the tubular element or through the wall of the tubular element to that side of the tubular element which faces away from the bottom flange in order to be fixed in place at that side or beyond that end, it being possible to remove the suture after detaching the one end of the suture by pulling on the other end of the suture and those parts of the suture running over the tubular element being guided in guide means,
30 such as small tubes or conduits.

107. An assembly of a fixing device according to Claim 92 and an obturator cap, which can be accommodated therein, for occluding the passage surrounded by the tubular or tube-like element, wherein the obturator cap is covered on at least one side with one

of vascular wall tissue, pericardium, vascular prosthesis and anti-clotting material.

108. An assembly comprising a prosthesis fixing device according to claim 72 and a surrounding sleeve, wherein the fixing device is compressible from the fitted state for contact with the peripheral wall part to a compressed state, wherein the fixing device is
5 arranged, in its compressed state, in the surrounding sleeve which defines a circumference smaller than the circumference of the fixing device in its fitted state.

109. The assembly according to claim 108, wherein the prosthesis fixing device has in the compressed state a spirally wound configuration.

110. The assembly according to claim 108, wherein the prosthesis fixing device has
10 in the compressed state a folded configuration.

111. An assembly comprising a fixing device according to claim 92 and a surrounding sleeve, wherein the fixing device is compressible from the fitted state for contact with the vascular wall tissue surrounding the passage to a compressed state, wherein the fixing device is arranged, in its compressed state, in the surrounding sleeve
15 which defines a circumference smaller than the circumference of the fixing device in its fitted state.

112. The assembly according to claim 111, wherein the fixing device has in the compressed state a spirally wound configuration.

113. The assembly according to claim 111, wherein the fixing device has in the
20 compressed state a folded configuration.

114. The prosthesis fixing device according to claim 72, wherein the tubular element is made up of segments held together by means of a flexible wire extending along all segments.

115. The prosthesis fixing device according to claim 72, wherein the tubular element
25 is made up of segments held together by means of connecting wires extending between each adjacent segment.

116. The prosthesis fixing device according to claim 115, wherein the connecting wires are made of a superelastic metal alloy with shape memory.

117. The fixing device according to claim 92, wherein the tubular element is made up
30 of segments held together by means of a flexible wire extending along all segments.

118. The fixing device according to claim 92, wherein the tubular element is made up of segments held together by means of connecting wires extending between each adjacent segment.

119. The fixing device according to claim 118, wherein the connecting wires are made of a superelastic metal alloy with shape memory.